

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION SPECIFICATION

Electron Tube, Cathode Ray, All Glass, 7-inch and 9-inch Diagonal, with Laminated Implosion Panel Etched and Anti-Reflection Coated

1. SCOPE

1.1 Scope. - The component covered by this specification is a 7-inch and 9-inch diagonal, high resolution, all glass cathode ray tube with a 70° magnetically driven deflection angle and electrostatic focusing. The faceplate shall be provided with an implosion panel made of tempered glass etched on both faces. The front face shall be coated with a special anti-reflective coating as specified herein. The panel shall be bonded to the front surface of the faceplate.

2. APPLICABLE DOCUMENTS

2.1 FAA Standard. - The following FAA Standard of the issue in effect on the date of the invitation for bids or requests for proposal forms a part of this specification and is applicable to the extent specified herein.

2.1.1 FAA Standard.

FAA-STD-013 Quality Control Program Requirements

(Copies of this specification, and of the applicable FAA standard, may be obtained from the Federal Aviation Administration Contracting Officer issuing the Invitation for Bid or Request for

Proposal. Requests should fully identify material desired, i.e., specification numbers, dates, amendment numbers; also, requests should state the contract involved or other use to be made of the requested material.)

2.2 Military Specifications and Standards. The following Military specifications and standards of the issue in effect on the date of invitation for bids or request for proposals form a part of this specification to the extent specified herein.

2.2.1 Military Specifications.

MIL-E-1 () Electron Tubes, General Specifications for
MIL-E-75 Electron Tube, Preparation for Delivery of
MIL-C-675 Coating of Glass Optical Elements (Anti-Reflection)
MIL-M-13508 Mirror Coating Process: Front surfaced
aluminized, for Optical Elements

(Specification MIL-E-1 (), which includes a large basic specification and over 1000 tube specification sheets, is not generally available. However, where adequate justifying statements are included in written requests directed to FAA (attention of the Contracting Officer), needed sections of MIL-E-1 () may be obtainable. Requests should contain separate justifications for the basic specification (if needed) and for specific supplement sheets covering individual tubes. Unjustified requests for MIL-E-1 () cannot be processed.)

2.2.2 Military Standards.

MIL-STD-105 Sampling Procedures and Tables for
Inspection by Attributes
MIL-STD-1311 Test Methods for Electron Tubes
MIL-STD-781 Reliability Tests: Exponential Distribution
MIL-STD-202 Test Methods for Electronic & Electrical
Component Parts
MIL-STD-130 Identification Marking of U. S. Military
Property

2.3 Industry Specifications. The following specifications of the issues in effect on the date of invitation for bids or request for proposals form a part of this specification to the extent specified herein.

GTA62-8-7 Safety Windows for Laminating to TV Tubes

(Copies of the above specification may be obtained by request from the Glass Tempering Association, 1325 Topeka Avenue, Topeka, Kansas 6612 Attention: Raymond Eurick, Executive Director Tel. (913) 234-5715.

2.4 Application of Subparagraphs. Wherever, in this specification and in the applicable documents (section 2), reference is made to a specific portion of a document (e.g., section, paragraph or subparagraph), it shall be understood that all subportions and subparagraphs thereunder shall apply also.

3. REQUIREMENTS.

- 3.1 General. Electron tube, cathode ray, all glass, 7-inch and 9-inch diagonal, high resolution, magnetic deflection, 70 degrees, electrostatic focus, aluminized screen, faceplate with laminated implosion panel, light etched and anti-reflection coated surface. All terms and symbols which are not defined or explained in this specification shall be as defined or explained in the applicable documents (see section 2 hereof).
- 3.1.1 Dimensions and pin connections. Dimensions and pin connections are as shown in Figure 1 (pages 1 and 2).
- 3.2 Ratings. Ratings shall be as listed below. All voltages with respect to cathode with the exception of the filament voltage. Symbology in accordance with MIL-E-1 ().

		Focus						
Parameter:	Ef	Anode Ehl	Ecl	Ec2	Eb2	Ehk	Rgl	Rg2
Units:	VAC	VDC	VDC	VDC	KVDC	VDC	Meg.	Meg.
Maximum:	6.93	1000	0.0	800	20.0	200	1.5	. 5
Minimum:	5. 97	-100	-200		6.0	-200		
Test Cond:	6.3	50	-30	400	12.0			·
	to	350 t	0 -70					

3.3 Materials. Materials and processes used in the construction of the tubes shall be in accordance with MIL-E-1 (), paragraph 3.5 and the following:

The tube shall have a glass faceplate and tempered glass implosion panel (as specified in GTA62-8-7), bonding resin number TV-720 with hardener number DEH-66 (DOW Chemical Company), or PPG 5234 resin and suitable hardener (Pittsburg Plate Glass Company), or equivalent. The implosion panel shall be surface etched and provide $50\% \pm 5\%$ transmissivity. The implosion panel will be tested and considered acceptable when the threshold resolution observed through the panel is in the range from element 2 of group +0 (corresponding to 1.1225 line pairs/mm) to element 6 of group +1 (corresponding to 3.5636 line pairs/mm) when using USAF resolution chart data (see Figure 3.) and USAF resolving power test target type 1951 (see Figure 2.). An antireflection coating shall be applied to the front surface only of the implosion panel (which is etched on both sides). This coating shall be a High Efficiency Anti-Reflective (HEA) coating, which will provide a reflectivity as specified in paragraph 3. 3. 1 over the wave length range of 425 millimicrons (or nanometers) to 700 millimicrons, as measured with GAMMA SCIENTIFIC Co. Model #191 spectrophotometer (or equal) using a smooth, flat, polished glass specimen.

3. 3. 1 Durable First Surface HEA for Etched CRT Implosion Panel. The reflectance from a single coated surface, measured at an angle between 0 degrees and 15 degrees and at an angle of 30 degrees shall not exceed the following limits:

Wave Length Range		Percent Re	flectance
	Angle = $0-$	15 degrees	Angle = 30 degrees
440 mu (milli-microns)	. 75 a	osolute	
450 mu	,. 5	11	
470 mu	. 3	H	
500-600 mu	. 4	11	
630 mu	. 25	11	
680 mu	. 5	11	
700 mu	. 75	11	
450-650 mu			.8 absolute
425-700 mu			.5 average
500-620 mu			.5 average

The coating shall be capable of withstanding continuous exposure for 24 hours in an atmosphere of 120 degrees F and 98% + 2% relative humidity without evidence of deterioration.

Following exposure to the temperature-humidity environment, the coating shall withstand being subjected to a 20 rub erasure abrasion resistance test without evidence of deterioration.

The coating shall withstand being immersed continuously for 24 hours in water containing 6 ounces of sodium chloride (common table salt) per gallon at room temperature without evidence of deterioration.

The coating shall withstand being subjected to the "Scotch Tape" test without evidence of deterioration.

The coating shall withstand continuous operation over a temperature range from -260 degrees C to +200 degrees C. The coating shall withstand temporary operation up to +300 degrees C.

The coating shall withstand continuous exposure to a salt spray atmosphere for 50 hours.

Processing shall not generate defects on the implosion panel exceeding the following limits:

0.070" plus 0.005" for each inch of edge length Edge chips: over six inches.

Jig marks and halo: Maximum extension into the implosion

panel face shall be 0.125" plus 0.015" for each inch of part length over nine

inches.

Digs, spatter, and pits shall not exceed #50. Lint pinholes and voids shall not exceed twice the dig size. Scratches shall not exceed #120.

Acceptance tests and measurements shall be made using polished glass witness pieces that have been coated in the same batch as the implosion panels being evaluated. Witnesses from each batch shall be tested in accordance with the requirements specified herein and the following documents:

> MIL-C-675A Para. 4.6.8, 4.6.9, and 4.6.11 MIL-M-13508B Para. 4.4.6 MIL-0-13830A Applicable requirements

Failure to meet one or more requirements shall be cause for rejection of that part.

- 3.3.2 Screen. The screen shall be aluminized E. I. A. P31 phosphor and shall exhibit a medium persistency.
- 3.3.3 Faceplate. Clear glass light transmittance 90%.
- 3.3.4 Bonded Implosion Panel. Etched, 50% + 5% transmittance.
- 3.3.5 Anti-reflection coating. HEA (see para. 3.3.1)
- 3.3.6 Holding Period. There shall be a 72-hour holding period prior to shipment to allow proper jell of PPG resins, if used.
- 3.3.7 Delaminations. There shall be no delaminations in the quality area of the CRT during the warranty period.
- 3.4 Marking. Shall be permanent, legible and applied in accordance with MIL-STD-130, and shall include manufacturer's name or symbol, type number, serial number, lot number, date code, a space for marking the date of installation, and part number. The tube shall be marked on the top of the bulb. Marking shall be located approximately as shown in Figure 1, but shall not interfere with the anti-corona coating area.
- 3.5 Blemishes. Blemish criteria shall be as described in Method 5106 of MIL-E-1, except that the number and sizes of spots, holes, and blemishes shall not exceed those specified below.

3.5.1 Faceplate quality area. Shall be 7.0 inches by 5.0 inches (9" tube) or 3.0 inches by 5.0 inches (7" tube) rectangle, centered on the faceplate.

3.5.2 Defects.

(a)	Blisters:	Minimum separation Maximum size Maximum quantity	5 inch 040 inch 10	ì
		Not more than 4 over	030 inch	Ł
(b)	Seeds:	Maximum size Maximum quantity	040 inch	L
		Not more than 4 over	030 inch	Ł
(c)	Stones,	scale, pits, opaque spots	s, glass knots, etc.	
		Maximum size	030 inch	L
		Not more than 4 over	025 inch	Ĺ

(d) Cords: Intensity shall be no worse than JEDEC sample #56.

(e) Scuff: Shall be no worse than JEDEC sample #60.

(f) Scratch: Maximum length 2 inches. Intensity shall be no worse than intensity sample #57.

Disregard all defects under . 010 inch.

3.5.3 Blemish defects - phosphor, resin, and implosion panel.

Size	e	Maximum No.
.010" to	. 020''	4
.020" to	. 03011	2
.030" to	. 040''	1

Outside the useful area:

\mathtt{Size}	Maximum No.
.010" to .020"	5
.020" to .030"	3
.030" to .040"	2

Disregard any blemishes under .010" unless clusters, which should be considered as one defect.

- 3.5.4 Elongated or elliptical defects. Elongated or elliptical defects will be judged using the equivalent (average) diameter, the length plus the width divided by two. The equivalent diameter will be compared to those figures given in paragraph 3.5.2 and 3.5.3. Elongated defects ≤ .005 inch wide may be disregarded.
- 3.5.5 Surface scratches. Surface scratches, within the face-plate quality area, having a width >.005 inch are not acceptable.
- 3.6 Environmental Requirements. The tubes shall be capable of withstanding any combination of the following environmental conditions without mechanical damage or degradation of electrical/photometric performance (para. 3.7 and Table I) beyond the limits specified.
- 3.6.1 Implosion Pressure. The CRT shall be capable of withstanding 45 pounds per square inch absolute.

- 3.6. 2 Barometric Pressure. The CRT shall be capable of operating normally at 30.0 inches of mercury (sea level) to 16.8 inches of mercury (15,000 feet).
- 3.6.3 Relative Humidity. The CRT shall be capable of operating in a relative humidity of 0 to 95%, including condensation due to temperature changes.
- 3.6. 4 Salt Atmosphere. The CRT shall be capable of operating in a salt atmosphere as found in coastal regions, and sea locations. This is a design objective and does not require an indepth test to MIL-STD-202. The tube shall perform as specified herein without derogation in continuous service.
- 3.6. 5 Ambient Temperature. The CRT shall be capable of operating in ambient temperatures of -45 degrees to +65 degrees C. and shall withstand a storage temperature from -55 degrees C. to +65 degrees C.
- 3.6. 6 Vibration. With the tube vibrated in accordance with method 5111 of MIL-E-1 (), the following shall apply:
 - (a) The line-width increase, or spot displacement, shall be 2 millimeters (mm).
 - (b) When tested in accordance with method 5201 of MIL-STD-1311, with Ecl= 0, the value of Ic2 shall be between -15 microamperes (uA) minimum and +15 uA maximum.
- 3.7 Electrical/Photometric. Includes applicable tests in Table I.
- 3.7.1 Interelectrode capacitance. The interelectrode capacitance shall be measured as described in Method 1331 of MIL-STD-1311 and shall not exceed the following:

Cathode (Ck) to all other elements - - - - 8.5pf max. Grid (Cgl) to all other elements - - - - 10.0pf max.

3.7.2 Deflection Angle, Diagonal. 70 degrees 2 degrees.

- 3.7.3 Spot Position, Undeflected. The spot position (undeflected), measured in accordance with Method 5231, paragraph 1 of MIL-STD-1311, shall fall within 0.25 inch diameter circle, the center of which coincides with the geometric center of the tube face.
- 3.7.4 Bias Requirements. No damage to the tube shall result if the high voltage and bias power supplies are applied without preheating the cathode.
- 3.7.5 Internal Arcing. With Eb2 = 15.0 KVdc and Ecl adjusted to provide a faint raster, the number of arcs at initial tube test by the manufacturer shall be zero after a period of 13 seconds. Flashing observed on the phosphor screen within the raster area shall be construed as an indication of arcing. There shall be no discernible arcing when all voltages are adjusted for normal operation. Any evidence of arcing beyond the allowed initial arc is cause for rejection.
- 3.7.6 Spot Diameter Change. The worst case spot diameter change from the center of the screen to any of the four diagonal corners within the quality area shall be $\leq 50\%$.
- 3.7.7 Test Conditions. Brightness shall be measured at the center of the screen in a single line by a spot photometer using an aperature .006 inch (effective diameter at the tube screen).
 - (a) The operating conditions of the CRT shall be:

Writing speed - - - 0.37 inches per microsecond
Refresh rate - - - 55 Hz
Anode potential - - - 12.0 KVdc
Spot diameter - - - 010 Max.
Brightness level - - - 60 foot lamberts Min.

Spot diameter = half brightness points determined by a slit analyzer,

Constantine Engineering Labs. Co. Type PC, or

equivalent.

(b) The average loading of the tube while in operation will be:

Cathode current (uA)	Percent of time
Cutoff	25
Less than 12.0	75

3.7.8 Stray Emission. There shall be no evidence of stray emission.

- 3.8 Mechanical. Dimensions and pin connections shall be as shown in Figure 1 and Figure 1A.
- 3.8.1 Anode Connector. Anode connector shall be JEDEC J1-21.
- 3.8.2 Base Connector. The base connector shall be small shell DUODECAL, B12-43.
- 3.8.3 Neck Straightness. The neck gauge, referenced in Method 5101, Table I, shall be 5 inches long (nominal) and have a 1.500 + .003 .000 inch maximum inside diameter. It shall be capable of sliding freely from the base to within 0.50 inch of the reference line.

3.8.4 Etch Characteristics of the Implosion Panel

- 3.8.4.1 Surface etch. The surface etch of every implosion panel shall be tested in accordance with the following best method and acceptance criteria:
 - (a) A USAF resolving power test target type 1951 (three bar groups on an opaque background) is placed on a light box and observed through the etched implosion panel. A plexiglass spacer 1-1/2" high and 3-3/4" in diameter is used to space the implosion panel 1-1/2" from the resolution test target (Figure 2).
 - (b) The brightness of the light box and viewing conditions are selected to maximize the unaided resolution of an observer with normal or corrected-to-normal vision. The observer's vision and viewing conditions may be checked by placing a non-etched panel in the optical path. The observer should distinguish bars in at least group 3:6 corresponding to 14.25 line pairs/mm.
 - (c) The acceptance criteria is as follows:

Using the test method as described above, the panel etch is acceptable when the threshold resolution observed through the panel is in the range from 1:6 (corresponding to 3.5636 line pairs/mm) to 0:2 (corresponding to 1.1225 line pairs/mm) to 0:2 (corresponding to 1.1225 line pairs/mm). See Figure 3 for USAF resolution chart.

3.9 Reliability. The minimum acceptable mean time to failure, (MTTF) Ok as described in MIL-STD-781B, shall be 5000 hours under the most stringent operating conditions specified in paragraph 3.6. A failure is defined as non-compliance with any of the electrical/photometric requirements given in paragraph 3.7 and Table I with the following qualification. Cathode ray tube brightness may decrease linearly from 60 + 6 foot lamberts minimum to 30 + 3.0 foot lamberts minimum from zero to 5000 hours of "on" time under load conditions of paragraph 3.7.7. Brightness below 30 + 3.0 foot lamberts shall not be considered acceptable.

4. QUALITY ASSURANCE PROVISIONS.

- Unless otherwise specified in this cathode ray General. tube specification or in the contract, all tests and inspection to determine compliance with the electrical/photometric and mechanical requirements of the applicable specifications shall be made by the contractor at his plant and shall be subject to Government inspection. The term "Government inspection," as used in this specification, means that an FAA representative will witness the contractor's testing and inspection, and will carry out such visual and other inspection as deemed necessary to assure compliance with contract requirements. The Government reserves the right to waive Government inspection at the contractor's plant. If Government inspection is waived, the contractor shall furnish certified test data establishing proof of compliance with specification requirements. The test data must demonstrate that the tube meets contract requirements, include the statement, "This certifies that this unit fully meets all technical requirements of the contract, " and be dated and signed by a responsible official of the contractor. Shipment shall not be made until the contractor receives written Government approval of the submitted test data. The manufacturer shall comply with all of the quality control program requirements of FAA-STD-013.
- 4.2 Contractor's Preliminary Tests. Prior to the time the contractor formally notifies the Government that the initial production type tubes are ready for Government inspection, he shall make all tests which are necessary to prove compliance with this specification.

- 4.2.1 Preliminary Test Data. The contractor shall formally submit to the Government Contracting Officer a certified copy of the test data covering all preliminary tests made under paragraph 4.2. The test data shall be submitted together with (or in advance of) notification of readiness for inspection (4.2.2).
- 4.2.2 Notification of Readiness for Inspection. When the contractor has a CRT completed which meets all of these specifications, he shall formally notify the Government Contracting Officer that he is ready for Government inspection and tests. Upon acceptance of the test data (4.2.1), the Government shall notify the contractor when inspection shall start.
- 4.3 Visual Inspection. Prior to submittal for Government inspection and test (4.4), each tube to be delivered under the contract shall be visually inspected to determine general compliance with the requirements of this specification. This inspection includes checking for proper heater functioning and applicable mechanical inspection per MIL-E-1 ().
- 4.4 Government Inspection and Testing. Each tube shall be serialized or identified in accordance with paragraph 3.4. Following the holding period per MIL-STD-1311, paragraph 4.8.5, and preheating per MIL-STD-1311, paragraph 4.8.6.1, Government inspection and testing shall be performed as described below.
- 4. 4. 1 Design Qualification Tests. Sixteen (16) to twenty (20) tubes from the initial production lot shall be subjected to the following tests. Failure to comply with the acceptance criteria shall be cause for suspending production until a plan for corrective action is agreed on by the contractor and procuring activity. The tubes used in these tests shall not be considered part of the deliverable quantity as specified in the contract.
- 4.4.1.1 Reliability Testing. Twelve (12) tubes shall be tested in accordance with Test Plan XX of MIL-STD-781B, Test Level A-1, to determine compliance with paragraph 3.9. Failed tubes shall not be repaired or replaced. Specific tests and failure analysis procedures shall be submitted to the Government for approval 30 days prior to the test. The detailed requirements of Section 5 of MIL-STD-781B shall generally apply.

- 4.4.1.2 Shock. The test shall be performed in accordance with Method 205, test condition A of MIL-STD-202 under the following conditions:
 - (a) The tube subjected to this test shall be mounted to the shock machine by a suitable rigid assembly.
 - (b) The assembly shall be such as to permit changes in tube orientation. A total of ten (10) shocks shall be applied to the tube in the following sequence:

Order	Number of Shocks	Direction
1	2	Base to face
2	2	X+
3	2	X -
4	2	Y+
5	2	Y -

- (c) No potentials shall be applied to the tube during the shock treatment.
- (d) After the above shock treatment, the cathode ray tube (CRT) shall meet all of the requirements of this specification. In addition, the CRT shall be subjected to, and pass, the following tests:
 - (1) The change in position of the undeflected spot from its position noted before the test (see Method 5231 of MIL-STD-1311) shall not exceed 8mm.
 - (2) Starting (i. e., prior to shock treatment) with a CRT having no internal loose particles, the maximum number of loose particles in the CRT as a result of shocking, shall be no more than five (5) and none of these loose particles shall be greater than .020 inch in the largest dimension.

A CRT having loose particles greater than .020 inch shall be vibrated continuously with the face down in a horizontal plane at 5G's for one (1) minute. If the screen is visibly damaged from such vibration, the CRT shall be rejected.

- (3) There shall be no visible damage to the external parts of the CRT resulting from the above shock treatment.
- 4.4.1.3 Vibration Testing. Four (4) tubes shall be tested in accordance with paragraph 3.6.6. No failures are allowed.
- 4.4.1.4 Pressure Testing. Two (2) tubes shall be tested for resistance to implosion in accordance with paragraph 3.6.1 and MIL-STD-1311, Method 1141. No failures are allowed.
- 4. 4. 2 Type Testing (Sampling Tests). The following tests shall be performed for each production run. Failure to comply with the acceptance criteria shall result in rejection of the lot and production shall not resume until the contractor and procuring activity have agreed on a plan for corrective action. Unless otherwise specified in the production contract, an itemized lot shall consist of 200 CRTs based on a production rate of 80 per month minimum.
- 4. 4. 2. 1 Reliability Testing. Twelve (12) tubes shall be randomly selected and tested in accordance with Test Plan VIII of MIL-STD-781B, Test Level A-1, to determine compliance with paragraph 3.9. Failed tubes shall not be repaired or replaced. Specific tests and failure analysis procedures shall be submitted to the Government for approval 30 days prior to the test. The detailed requirements of Section 5 of MIL-STD-781B shall generally apply. Tubes that comply with the above requirements shall be considered part of the deliverable quantity as specified in the contract or used to perform other type tests.
- 4. 4. 2. 2 Vibration Testing. A random sample of two (2) tubes from the total contract quantity shall be tested in accordance with paragraph 3. 6. 6. No failures are allowed. These tubes shall not be considered part of the deliverable quantity as specified in the contract.
- 4.4.2.3 Pressure Testing. A random sample of two (2) tubes from each itemized lot shall be tested in accordance with paragraphs 3.6.1 and 3.6.2. No failures are allowed. These tubes shall be considered a part of the deliverable quantity as specified in the contract.

- 4. 4. 2. 4 Secureness of Base, Cap, Insert and Permanence of Marking Tests. These tests shall be performed in accordance with Method 1101A and 1105 of MIL-STD-1311. Sample selection shall be based on a plan from MIL-STD-105D corresponding to inspection level S1 and an AQL of 6. 5 percent. These tubes shall not be considered part of the deliverable quantity as specified in the contract.
- 4. 4. 3 Production Testing. The following tests shall be performed on each tube produced, including those used in design qualification and type testing described in paragraphs 4. 4. 1 and 4. 4. 2. Failure to comply with the acceptance criteria shall result in rejection of the tube.
- 4. 4. 3. 1 Mechanical Tests. These tests shall be performed in accordance with paragraph 3. 8.
- 4. 4. 3. 2 Electrical/Photometric Tests. These tests shall be performed in accordance with paragraph 3. 7 and Table I as applicable.
- 4.5 Inspection of Preparation for Delivery. Sample packages or packs, and the inspection of the preservation, packaging, packing and marking for shipment and storage shall be in accordance with the requirements of Section 5.
- 5. Preparation for Delivery. Preservation, packaging, packing and marking shall be in accordance with specification MIL-E-75. Appropriate levels shall be as specified per contract or order.
- 5. l Preservation and Packaging. Preservation and packaging shall be level A or C, as specified in the procurement solicitation and contract.
- 5.1.1 Level A. For direct shipments from the manufacturer to overseas destinations and for special AID, NAT or other projects marked for subsequent overseas shipments to be held at the Aeronautical Center staging area.
- 5.1.2 Level C. For shipment to Aeronautical Center for storage and for direct shipments from the manufacturer to destinations within the continental limits of the United States (CONUS).

6.0 NOTES.

6.1 Quality Conformance. Pages 18 through 25 cover quality assurance tests, drawings and resolution charts which are suggested for use in carrying out the quality conformance and inspection requirements of this specification. In this connection, refer also to the requirements of applicable FAA standard FAA-STD-013 (par. 2.1.1 hereof).

FAA-E-2481a

QUALITY CONFORMANCE INSPECTION

Quality conformance inspection: Shall consist of mechanical inspection per MIL-E-1 Part 1, Group A, a holding period, per method E-50.2, followed by preheating, per method E-50.3.1, (See Appendix E, MIL-E-1G), followed by the tests specified in Table I where:

Parameter Ef Ebl Ec2 Eb2

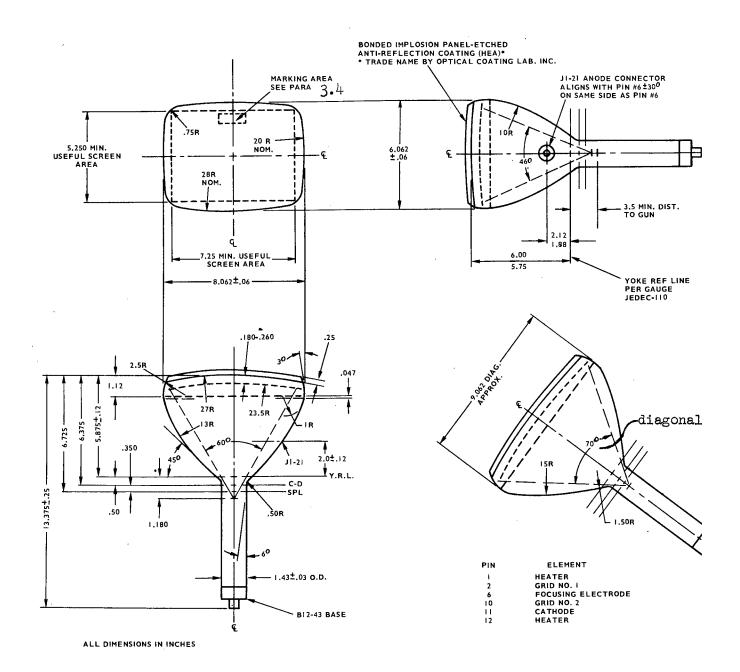
Test Condition 6.3 Adj. +50 to +350V Adj. -30 to -70V +400V +12KV Unless Specified Otherwise

TABLE I. Quality Conformance Tests

Method	Requirement			Li	nits	
or Para. MIL-E-l	or Test	Conditions	Symbol	Min,	Max.	Units
5201 5201 5201.2 5201.4 5206 5106	Grid No. 2 Current Focus Anode Current	Inspection Production Te Ecl=O Para. 3.5 Unblanked, Ib2=150uA interlaced 525 line TV Raster 4.5" x 6.5"	Ic2 Ib1 Gr 	-15 160	+15 5 0.25	μAdc μAdc FT Lamb.
5223 5231 5241 5246 5251	Modulation Spot Position Grid Cut-off Voltage Focusing Electrode Voltage Grid No. 1 leakage Internal arcing	Ib2 = 50 uAdc Para. 3.7.3 Ib2 = 25. uA Para. 3.7.5	Ecl Ecl Ebl.	-30 +40	35 . 250 - 70 + 340	V inch Vdc V uAdc

TABLE I. Quality Conformance Tests (Cont'd)

			1			r
Method	Requirement		1	T*i	mits	
1 1	-	Conditions	Symbol			Units
or	or	Conditions	Symbol	171111	wiax.	Ullits
Para.	Test				Ì	
MIL-E-I			l	**.		<u> </u>
	Acceptanc	ce Inspection - Desi	gn Quali	ficati	on Tes	<u>ts</u>
1141	Pressure (Implosio	on) Para. 3.6.1	,		45.0	psia
1301	Heater Current	•	If	540	660	mA
5101	Alignment, side	•	!		±30	degrees
3.01	terminal and base					
5101	Neck straightness	Para. 3.8.3				
5216	Stray emission	Eb2=15.0 KVdc				
3210		Ec2=600 Vdc;				
	(None allowed)					
	•	Eb1=0	1			1
		Ecl=-200		*	010	. ,
5226	Linewidth "A"	Ib2=150 μA			.010	inch
		TV raster 525 line				
5251	Heater-cathode					
	leakage					
5251	Grid No. 2 leakage	·			5	μAdc
						
	Acceptanc	e Inspection Type Tests	į		! !	[
	Linewidth "A"	Ib2= 150 uA			.010	inch
		*				
. 1141	Pressure (Implosion) Para. 3.6.1			45.0	psia
1141	Pressure (Altitude)		Hg	30	16.8	inches
5111	Vibration	Para. 3.6.6	width		2	mm
1331	Direct-interelec-	2 22 2. 3, 3, 3, 3	Ck to all	~	8, 5	. pf
1331	1		gl to all		10	pf
	trode capacitance	Days 3 7 4	gr to arr			
	Spot dia. change	Para. 3.7.6				ļ
1	į	•				1
<u> </u>			L		لــــــا	L



9-INCH (DIAGONAL) CRT
Figure 1 (1 of 2)

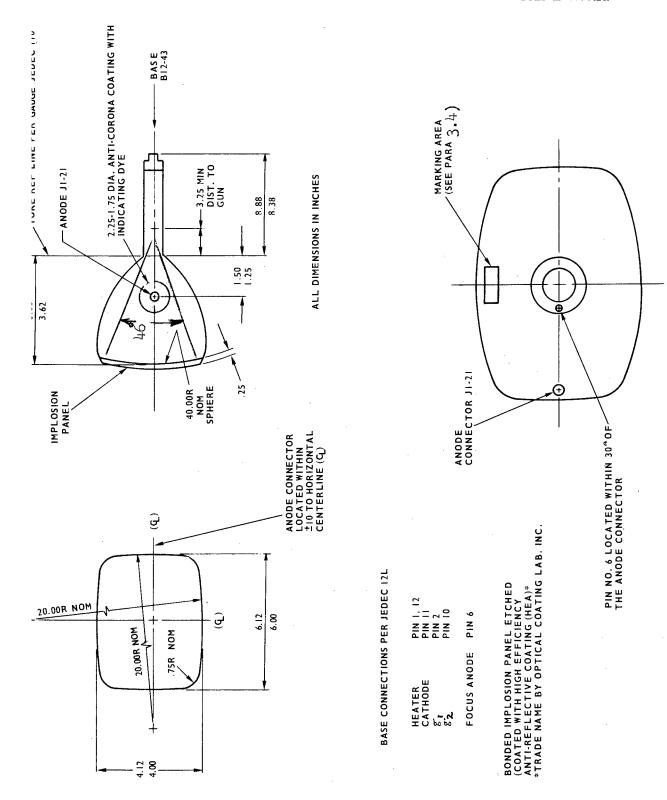
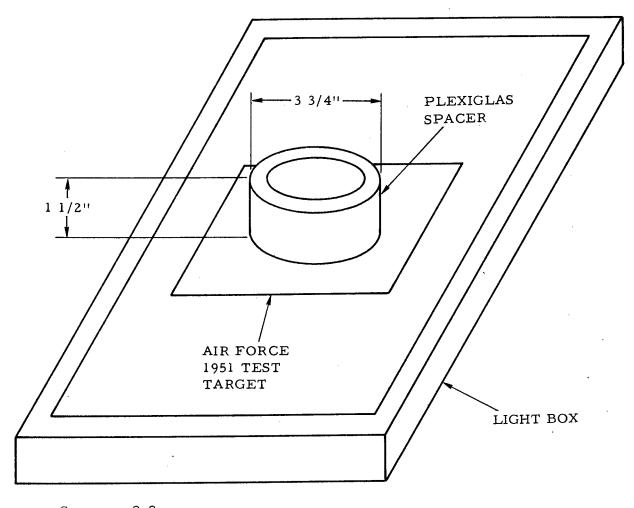


Figure 1 (2 of 2) - 7-INCH (DIAGONAL) CRT



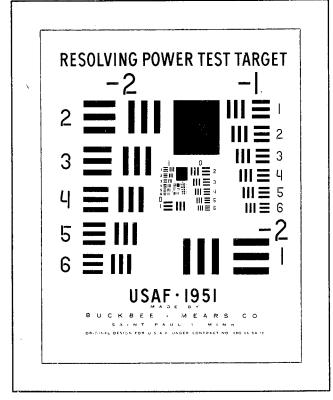
See par. 3.3

RESOLUTION TEST JIG FOR CHECKING CRT IMPLOSION PANEL ETCHING Figure 2



USAF RESOLUTION CHART DATA

NOMENCLATURE AND SPECIFICATIONS



The proportionality of the line and element dimensions is given by the ratio of the unit widths of two subsequent elements. This ratio shall be the sixth root of two. At the head of every group shall be a group number indicating the number of li/mm of the largest pattern within the group in terms of powers of two. For example, a group number K-3 shall indicate eight li/mm for the largest pattern of this group. The group numbers shall be whole numbers, for example—I, 0, I etc. Within a group, every element shall be designated by an element number n=1 (number I belonging to the largest element) through number 6 (number 6 belonging to the smallest element). The resolving power R represented by the element n of group K of the target can then be calculated from the equation.

$$R = {}_{2}K$$
 plus n-1

Thus element I of group —2 has 0.25 li/mm, element I of group —1 has 0.5 li/mm, and element I of group 0 has I li/mm.

The range of the target shall include ten target groups from 0.25 to 227.5 li/mm or from group —2 to group 7.

Interval—a line or a space.

Unit—a line and the adjacent space.

Pattern—three lines and two included spaces.

Element—an arrangement of two patterns set at right angles to each other and separated by one unit width.

	GROUP2	G	ROUP -1
(1) ,25 li. m/m	Interval = .07874 Unit = .15748	(1) .50 li. m/m	Interval = .03937 Unit = .07874
. (Element .94488 × .3937	1	Element .47244 × .19685
(2) .280625 ii. m/m	Interval = .07014699 Unit = .14029398	(2) .56125 li. m/m	Interval = .03507349665 Unit = .0701469933
	Element .84176388 × .35073495	(Element .4208819598 × .17536748325
(3) .317475 li. m/m	Interval = .06200488225 Unit = .1240097645	(3) .63495 li. m/m	Interval = .0310024411 Unit = .0620048822
	Element .744058587 × .31002441125	()	Element .3720292932 × .1550122055
(4) .356175 li. m/m}	Interval = .0552677756 Unit = .1105355513	(4) .71235 li. m/m	interval = .0276338878 Unit = .0552677756
(Element .6632133078 × .27633887825		Element .3316066536 × .138169439
(5) .3994 li. m/m	Interval = .0492864296 Unit = .0985728592	(5) .7988 li. m/m	Interval = .0246432148 Unit = .0492864296
	Element .5914371552 × .246432148	(Element .2957185776 × .123216074
(6) .44545 li. m/m	Interval = .04419126725 Unit = .0883825345	(6) .8909 li. m/m	Interval = .0220956336 Unit = .0441912672
(Element .5302952124 × .2209563385	(Element .2651476032 × .110478168

GROUP + 0	GROUP + 1
(1) Interval = .019685 Unit = .03937 Element .23622 × .098425	(1) Interval = .0098425 Unit = .019685 Element .!!8!1 × .0492125
(2) Interval = .01753674832 Unit = .03507349665 Element .2104409799 × .087683741625	(2) Interval = .00876837416 Unit = .01753674832 Element .10522048992 × .0438418708
(3)	(3) 2.5398 li. m/m
(4) Interval = .01381694391 Unit = .02763388783 Element .16580332698 × .069084719575	(4) Interval = .00690847195 Unit = .01381694391 Element .08290166346 × .034542359775
(5) Interval = .01232160741 Unit = .02464321482 Element .14785928892 × .06160803705	(5) 3.1952 li. m/m { Element .07392964446 × .030804018525
(6) Interval = .01104781681 Unit = .02209563362 Element .13257380172 × .05523908405	(6) Interval = .0055239084 Unit = .01104781681 Element .06628690086 × .027619542025
(Element .13257380172 × .05523908405	6101242416110. X 08004682660. Tremeil j
(Element .13257380172 × .05523908405	GROUP + 3
	GROUP + 3
GROUP + 2 (1) Interval = .00492125 Unit = .0098425	GROUP + 3
GROUP + 2 { Interval = .00492125 Unit = .0098425 Element .059055 × .02460625 { Interval = .00438418708 Unit = .00876837416 Element .05261024496 × .0219209354 Element .05261024496 Element .	GROUP + 3 (1) Interval = .002460625 Unit = .00492125 Element .0295275 × .012303125
GROUP + 2 {1)	GROUP + 3 {1} 8 li. m/m
GROUP + 2 Interval = .00492125 Unit = .0098425 Element .059055 × .02460625 Interval = .00438418708 Unit = .00876837416 Element .05261024496 × .0219209354 Interval = .00387530514 Unit = .00775061028 Element .04650366168 × .0193765257	GROUP + 3 {1) 8 li. m/m

Figure 3 (2 of 3)

GROUP +4	GROUP+5
(1) Interval = .0012303125 Unit = .002460625 Element .01476375 × .0061515625	(1) 32 li. m/m {
(2) Interval = .00109604677 Unit = .002192093541 Element .013152561246 × .0054802338525	(2) Interval = .000548023385 Unit = .00109604677 Element .00657628062 × .002740116925
(3) Interval = .000968826285 20.3184 li. m/m {Element .011625915426 × .0048441314275}	(3) Interval = .0004844131425 40.6368 li. m/m
(4) Interval = .000863558994 22.7952 li. m/m {Element .010362707934 × .0043177949725}	(4) Interval = .000431779497 Unit = .000863558994 Element .0051813053964 × .0021588772485
(5) Interval = .000770100463 Unit = .001540200926 Element .009241205556 × .003850502315	(5) Interval = .0003850502315 Unit = .000770100463 Element .004620602778 × .0019252511575
(6) Interval = .000690488550 Unit = .001380977101 Element .008285820606 × .0034524252525	(6) Interval = .000345244275 57.0176 li. m/m
GROUP + 6	GROUP + 7
(1) (Interval == .000307578125	(Interval = .0001537890625
(1) 64 li. m/m	(1) 128 li. m/m Element .00184546875 × .0007689453125
Unit = .00061515625 Element .0036909375 × .001537890625 [2] 71.84 li. m/m	
(2) Interval = .0002740116925 Unit = .000548023385	128
(2) 71.84 li. m/m {	(2) Interval = .0001370058463 Unit = .0002740116926 Element .0016440701556 × .0006850292315
(2) 71.84 li. m/m	(2) Interval = .0001370058463 Unit = .0002740116926 Element .0016440701556 × .0006850292315 (3) Interval = .0001211032856 Unit = .0002422065713 Element .0014532394278 × .00060551642825
[2] 71.84 li. m/m {	(2) Interval = .0001370058463 Unit = .0002740116926